REMARKS

Claims 1 and 4-14 are pending in the present application. Claim 15 is withdrawn from consideration. Claims 1 and 4-14 are rejected. Claims 1 and 14 are herein amended. No new matter has been entered.

Claim Rejections - 35 U.S.C. §103

Claims 1, 4-6 and 14 are rejected under 35 U.S.C. §103(a) as being unpatentable over Yonehara et al. (US 2003/0159644 A1) in view of Applicants' allegedly admitted prior art.

The Examiner notes that the mean thickness within the range of the cited reference (=10.05 μm), and the mean boron concentration (= ~5 x 10^{19} cm-3), together, meet the range as claimed, which is (2.0-2.4) x 10^{16} x exp (0.21 x 10.05).

The Examiner has utilized an imaginary substrate having a thickness equaling the mean thickness between the least and most thickness of the cited reference, and a boron concentration equaling the mean concentration between the maximum and minimum boron concentrations of the cited reference. However, the Examiner still can not show that a cited reference discloses the claimed range of boron at a concentration higher than or equal to 5×10^{16} (atoms/cm^3) and lower than or equal to 2×10^{17} (atoms/cm^3).

Applicants note that the characteristics of an epitaxial wafer, for example, gettering ability, have a strong dependence on a concentration of boron and a thickness of epitaxial layer (a thickness of the crystal layer). In the present invention, calculating a value based on a mean

thickness of a factor that has an effect to the characteristics (here, the thickness of the crystal layer) has no physical meaning.

Applicants submit that the independently selected mean thickness and mean boron concentration do not represent a meaningful example, since no example meeting the above parameters has been shown. The Examiner is citing the mean of the thickness and boron concentration, rather than the actual values as taught in examples.

Applicants respectfully disagree with the above rejection, and submit that the Examiner is mischaracterizing both the claimed invention and the cited reference.

Claim 1 recites,

A semiconductor substrate …

wherein said semiconductor substrate …**contains boron at a concentration higher than or equal to 5×10^{16} atoms/cm^3) and lower than or equal to 2×10^{17} (atoms/cm^3);** … and

wherein a minimum value of the concentration of boron [B] (atoms/cm^3) is defined for a required thickness t (μm) of the crystal layer, based on a relational equation $[B] \geq (2.2 \pm 0.2) \times 10^{16} \exp(0.21t)$.

It is only the bolded highlighted above that Applicants have asserted minimally overlaps that of the cited reference. That is, the substrate of the present invention contains boron at a concentration higher than or equal to 5×10^{16} (atoms/cm^3) and lower than or equal to 2×10^{17} (atoms/cm^3). There is an additional claimed limitation that the minimum value of the concentration of boron [B] (atoms/cm^3) is defined for a required thickness t (μm) of the crystal layer is further based on a relational equation $[B] \geq (2.2 \pm 0.2) \times 10^{16} \exp(0.21t)$.

In page 25, lines 10-16 and 22-25, of the specification of the present invention it is disclosed that, "Fig. 10 is a characteristic chart made by plotting substrate boron concentrations for various epitaxial layer thicknesses when epitaxial wafers have gettering abilities superior to that of the reference wafer 1 (or have residual iron concentrations lower than that of the reference wafer 1) ... Fig. 10 shows acceptable gettering abilities provided by epitaxial thicknesses t (μm) and substrate boron concentrations [B] (atoms/cm^3) by Equation (1)".

It is clear that Fig. 10 noted only the range of 5 x 10^{16}/cm^3 ~ 2 x 10^{17}/cm^3 which is the range of boron concentration in substrate surface of the present invention. A relationship with a thickness (t) of the crystal layer is defined only within this range. That is, the equation showing a curve in Fig. 10 which formulated experimentally is the above equation. Therefore, Applicants submit that the above equation would not apply to a concentration value which is out of the range of boron concentration in substrate surface, 5 x 10^{16}/cm^3 ~ 2 x 10^{17}/cm^3. This equation therefore would not be appropriate for the imaginary boron concentration proposed by the Examiner.

Applicants submit that the above equation is claimed to be functional in the claimed range of higher than or equal to 5 × 10^{16} atoms/cm^3) and lower than or equal to 2 × 10^{17} (atoms/cm^3). To emphasize this relationship, Applicants herein amend claims 1 and 14 to recite that, "a minimum value of the concentration of boron [B] (atoms/cm^3) is defined for a required thickness t (μm) of the crystal layer within said range of said concentration of boron, based on a relational equation [B] ≥ (2.2 ± 0.2) × 10^{16} exp (0.21t)."

Applicants submit that this clarifies that the claimed equation is indicative of the range of

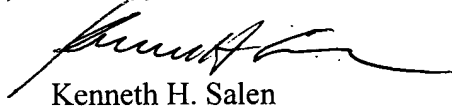$5 \times 10^{16}/cm^3 \sim 2 \times 10^{17}/cm^3$.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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